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PRICING AND DIVIDEND POLICIES IN OPEN CREDIT COOPERATIVES

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ABSTRACT

This paper develops an integrated model of pricing and dividend policies in open credit cooperatives (those that do business with members and non-members on a non-discriminatory basis). We show that both the distribution of member preferences and the amount of non-member business the cooperative does influence its optimal pricing and dividend policies. For a fixed distribution of member preferences, the larger the fraction of business done by members, the smaller the optimal dividend and the larger the optimal pricing subsidy (hence, increasing demand). On the other hand, for a fixed fraction of member business, the greater the skewness of member preferences toward loan (deposit) business with the credit cooperative, the larger the optimal dividend and the *higher (lower)* the optimal loan (deposit) interest rate. Aggregate empirical evidence from the German cooperative banking sector supports a version of the latter prediction, namely, that in an increasingly depositor-dominated open credit cooperative, average deposit rates tend to fall as dividend payouts rise.

Keywords: cooperative banks; corporate governance; not-for-profit institutions

JEL-Classification: G21, G32, L31

PRICING AND DIVIDEND POLICIES IN OPEN CREDIT COOPERATIVES

A credit cooperative has three channels for allocating benefits to its members: (high) deposit interest rates, (low) loan interest rates, and dividends. This paper develops an integrated model of pricing and dividend policies in open credit cooperatives, those that do business with members and non-members alike on a non-discriminatory basis. The model highlights two conflicting incentives inherent in the cooperative governance structure. We also show how the presence of non-members among the cooperative's customers affects the resolution of these incentive conflicts.

Members who want to borrow from a credit cooperative prefer low loan rates, all else equal, while those who want to lend to the cooperative prefer high deposit rates. Clearly, the "output-maximizing" incentive pits one group of members against another because the credit cooperative cannot raise deposit rates and lower loan rates simultaneously with a given amount of operating profit to distribute to members. Resolution of this conflict follows the preferences of the median member (Flannery, 1974; Smith, Cargill, and Meyer, 1981; Hart and Moore, 1998).

A second important incentive conflict in credit cooperatives concerns its dividend policy. All members prefer higher operating profits and dividends, holding all else equal, but this "profit-maximizing" incentive necessarily requires less favorable prices to one or more groups of cooperative members. Distribution of benefits in the form of dividends also may reduce efficiency losses from overproduction—an argument in favor of profit maximization—, but the controlling member group cannot capture all such benefits because minority members receive identical payments.

The presence of non-members among the customer base further complicates the analysis of incentive conflicts in credit cooperatives. Although some credit cooperatives, such as U.S. credit unions, exclude non-members, many other types, such as German cooperative banks, welcome non-member business. Terms are identical for members and non-members in the latter case, because the cost of differentiating prices based on membership status is too high (Grosskopf, 1990).

How are the output-maximizing and profit-maximizing incentives of open credit cooperatives reconciled? This paper addresses these issues using an integrated model of pricing and dividend policies in a credit cooperative that serves members and non-members on a non-discriminatory basis. We show that it is not sufficient to know the preferences of the median cooperative member; in fact, both the fraction of business that is done with non-members and the size of the controlling group of members turn out to be critical parameters.

Our first main result is that, the larger the proportion of the cooperative's business that is done with members, the stronger is the output-maximizing incentive. This holds regardless of the distribution of member preferences (i.e., borrower dominance or depositor dominance). The intuition for this result is that controlling members recognize that benefits in the form of favorably priced financial services "leak out" to non-members, too. As non-members become less numerous, the leakage becomes less of a deterrent to skewing the distribution of benefits toward favorably priced loans or deposits. Dividends necessarily are lower both because a lower operating profit is targeted and because overproduction entails efficiency losses.

Our second main result is that, the larger the controlling group's majority, the stronger is the cooperative's profit-maximizing (and dividend-paying) incentive. In parallel to the previous result, this holds regardless of the proportion of business that is done with non-members. The intuition for this result is that controlling members seek to balance the benefits they receive from the cooperative in the form of favorable prices on financial services and those delivered in the form of dividends. As the size of the controlling majority increases, the efficiency losses from overproduction loom ever larger. Reinforcing this consideration, the scope for transferring benefits from the minority group to the majority group declines as the ratio of the former to the latter shrinks toward zero. Taken together, the implication is that the controlling group's benefits received as dividends would shrink more rapidly than the depositors' surplus could increase under unchanged pricing and dividend policies. Thus, the larger the controlling majority, the less favorable the pricing and the higher the dividend payout rate. In the limit, a credit cooperative operates like a shareholder-owned bank, limiting loan and deposit quantities to, and setting prices at, the level dictated by pure profit maximization.

Empirical evidence that supports the model's predictions is drawn from the German cooperative banking sector over the period 1981-97. The model of this paper is well-suited to the analysis of German cooperative banks both because these banks do business with members and non-members on a non-discriminatory basis and because they pay substantial dividends to members. In 1997, for example, German cooperative banks paid an average of 75 percent of their after-tax income as dividends to members, an amount equivalent to a 4 percent return on the book value of equity (capital plus reserves) at the end of the previous year (OECD, 1999). Our model predicts that, in an increasingly depositor-dominated open credit cooperative, average deposit rates and dividend payout rates will be negatively correlated. This is precisely what we find for the German cooperative banking sector as a whole (primary banks only)—which plausibly became more depositor-dominated as time passed.

The paper is organized as follows. Section I provides a brief overview of the literature on credit cooperatives with special reference to German cooperative banks. Section II introduces the model and applies it to the case of a borrower-dominated membership, as was true of the early history of virtually all credit cooperatives. Section III extends the analysis to the case of a depositor-dominated membership, as many credit cooperatives have become, including the German cooperative banking sector. Section IV outlines our empirical strategy and discusses our results. Section V concludes.

I. Theory and Practice of Open Credit Cooperatives

Our brief review of the literature focuses on three strands of research that relate in some way to open credit cooperatives: 1) the pure theory of credit cooperatives, 2) research on mutual depository institutions in the United States, and 3) studies of the German cooperative banking sector. The first strand of relevant literature has become more active recently. Although theoretical papers in this literature provide interesting analytical insights into some of the mechanisms at work in the governance of credit cooperatives, there remains a dearth of empirical research that tests the important predictions of the models. The second strand of the literature is older, more voluminous, and includes both theoretical and empirical papers, but its application is limited by construction to the analysis of mutually owned depository institutions found in the United States, such as credit unions and mutual savings associations. This is unfortunate because, in the terminology of our paper, credit unions and some other types of mutuals are "closed" credit cooperatives, dealing only with members. The third strand of the literature surveyed here has, like the second strand, a long and rich history, but it has been focused generally on institutional details at the expense of insightful economic theorizing or conclusive empirical testing of hypotheses.

The pure theory of credit cooperatives. A few recent papers explore the theoretical foundations of credit cooperatives. Besley, Coate, and Loury (1993) examine the sustainability and allocation rules in rotating saving and credit associations, a common form of rudimentary credit cooperative found all around the world. Hart and Moore (1996, 1998) study decision-making in consumer cooperatives generally, but their analysis is relevant also for credit cooperatives. They highlight the possibility of cooperative decision-making resulting either in "inefficient inclusion" (related to our focus on "output-maximization" incentives) or "inefficient exclusion" (related to our "profit-maximization" incentives). Hart and Moore (1998) also provide an analysis of dividend-paying cooperatives, which this paper extends. Finally, Canning, Jefferson, and Spencer (1999) examine optimal pricing policies in not-for-profit financial institutions, a related but somewhat constrained version of the credit cooperatives we study.

The models in all of the papers noted above are kept simple in order to illuminate several basic tensions and trade-offs in cooperatives. Unfortunately, the range of testable hypotheses they generate is limited because the models abstract from a great deal of institutional detail such as differing levels of majority control, non-member business activity, and payment of non-trivial dividends to members.

Research on mutual depository institutions in the United States. Many different institutional types of depository institutions exist in the United States as elsewhere. Mutuals are a relatively small but resilient class of depository institutions, consisting of credit unions, mutual savings banks, and mutual savings and loan associations (Shay, 1992). Research interest has been strongest in the credit-union movement, not least because credit-union leaders and members often portray credit unions as being very different from their for-profit depository rivals.

Indeed, the one-member, one-vote governance structure of credit unions makes them an interesting case. Much of the focus of academic research on credit unions, however, has aimed to show that in fact credit unions are *not* all that different from other banks. Similarities exist in terms of the existence of important scale economies, managerial agency problems, and a nascent profit motive (Taylor, 1971; Flannery, 1974; Smith, Cargill, and Meyer, 1981; Smith, 1984, 1986; Patin and McNeil, 1991; Emmons and Schmid, 1999).

An important distinguishing feature of credit unions for our purposes is their members-only business policy, so very little of the research on credit unions can be applied directly to open credit cooperatives. Also in contrast to the German cooperative banks we highlight, U.S. credit unions pay only a trivial member dividend, if any, out of operating surplus. Instead, benefits are distributed primarily through the interest rates charged on loans and deposits. One implication of these differences is that, while a median-voter model is appropriate for credit unions because decisions about distributing surplus are relatively straightforward, it is not appropriate for open credit cooperatives that pay non-trivial dividends. In this case, the distribution of member preferences and the importance of non-members in cooperative business are both important.

Studies of the German cooperative banking sector. The cooperative banking sector in Germany has a long and rich history (Bonus and Schmidt, 1990; Aschhoff and Henningsen, 1996). The primary (local) cooperative banks and their associated regional and national financial institutions are significant competitors in the German financial landscape, having demonstrated flexibility in adapting their business practices to competitive challenges and changing member preferences (Selbach, 1991; Emmons and Mueller, 1998). Economic analysis of German cooperative banks has been primarily institutional in nature (Bonus, 1986; Grosskopf, 1990; Paaßen, 1991), while only a few papers have been empirical (Gorton and Schmid, 1999, study Austrian cooperative banks).

While essential for understanding the historical evolution and current state of the German cooperative banking sector, institutional analyses in general have not produced many empirically testable hypotheses about open credit cooperatives. At the same time, research into the pure theory of credit cooperatives and U.S.-focused research on the mutuals that operate there have been ill-suited for studying the German cooperative banking sector. This is particularly so with regard to its policy of doing business with non-members and paying significant dividends to members. In 1997, for example, German cooperative banks paid an average of 75 percent of their after-tax income as dividends to members, an amount equivalent to a 4 percent return on the book value of equity (capital plus reserves) at the end of the previous year (OECD, 1999). Furthermore, their dividend payment rate as a fraction of the balance-sheet total was nearly as high as that of the large commercial banks in Germany over our sample period (OECD, 1992, 1999). This paper is an attempt to bring together elements from all three strands of research in order to shed new light on the mechanics and incentives at work in open cooperative banks.

II. Pricing and Dividend Policy In a Model of Open Credit Cooperatives

The model we examine is an extension of Smith, Cargill, and Meyer (1981), who studied credit unions. We focus on an open credit cooperative (henceforth, a cooperative bank) with some degree of local market power. That is, the bank faces a downward-sloping demand curve for loans as well as an upward-sloping supply curve for deposits. These demand and supply curves (discussed further below) include both members and non-members. The cooperative bank makes no distinction between the two groups when accepting deposits or making loans; this corresponds to the practice of German cooperative banks today (Grosskopf, 1990).

A. The Model

The cooperative bank has two types of members, lenders (depositors) and borrowers. We assume for simplicity that cooperative members are either lenders or borrowers but not both. Furthermore, all borrowers are identical and all lenders are identical, except that some borrowers and some lenders are members while others are not. In equilibrium, all members do business with the cooperative. The number and identity of members is fixed and known in advance. We let α $(0 \le \alpha \le 1)$ denote the fraction of the membership that would like to borrow from the cooperative bank. Hence, a fraction $1-\alpha$ of the members want to deposit money at the bank. For convenience, we define $\beta \equiv 1-\alpha$. The cooperative bank has unlimited access to an interbank market for loans and deposits, both at the interest rate *r*, to square up its balance sheet. Individuals do not have access to the interbank market. For simplicity, we assume the bank faces no non-interest costs.

The cooperative bank chooses its deposit and loan interest rates, and its operating profit according to the one-member, one-vote principle. We assume that the cooperative has no use for the operating profit other than distributing it to its members as dividends, E.[1] We let κ $(0 < \kappa \le 1)$ denote the fraction of the bank's borrowers that are members, while λ $(0 < \lambda \le 1)$ is the fraction of depositors that are members. The cooperative bank faces linear loan-demand and deposit-supply curves which are as follows in indirect form:

(1a) $$p(x) = a - bx, \;\; a,b > 0, \;\; p, \frac{a-p}{b} \ge 0$$

(1b) $$q(y) = c + dy, \;\; c,d > 0, \;\; q, \frac{q-c}{d} \ge 0$$

where p and q denote the borrowing rate and the deposit rate, respectively; x and y are the amount of loans made and deposits accepted by the bank, respectively. We assume that the borrowers' maximum willingness-to-pay for a loan, a, exceeds the interbank rate, r, whereas the depositors' minimum willingness-to-accept for a deposit, c, falls short of the interbank rate.

B. A Borrower-Dominated Cooperative Bank

First assume that $\alpha > 1/2$, that is, the bank is borrower-dominated. This corresponds to the historical situation in many credit cooperatives, including the German cooperative banks.

The fraction of loan business done with members is κ , $(0 < \kappa \leq 1)$. A borrower-dominated cooperative bank solves the following optimization problem:

(2a) $$\underset{p,q,E}{Max} \left\{ \kappa \cdot x(p)\left(\frac{a-p}{2}\right) + \alpha \cdot E \right\}$$

subject to

(2b) $$E = p \cdot x(p) - q \cdot y(q) + r\left[y(q) - x(p)\right]$$

(2c) $$p \geq q$$

(2d) $$E \geq 0,$$

where $\alpha \; > 1/2$. The objective function is the sum of the member borrowers' surplus from obtaining credit at the cooperative and their share of the cooperative's operating profit. The borrowers' surplus is the integral between the loan demand curve and the borrowing rate, calculated over the total amount of loans. Only a fraction κ of this benefit created by lending is captured by member borrowers, the remainder going to non-member borrowers. Likewise, only the fraction α of the cooperative's operating profit is paid to borrowing members.

It is evident from (2a) that the essence of the borrower-dominated open credit cooperative's decision-making problem is how to balance its incentive to maximize the output of loans (i.e., borrowers' surplus) against its incentive to maximize operating profit (i.e., dividend payements). Part of the borrowers' surplus leaks out to nonmembers, whereas part of the dividend payments must be shared with member depositors.

Constraint (2b) relates the cooperative's pricing policies to its operating profit, and hence to its dividend payout. The borrowing rate cannot fall below the deposit rate to rule out arbitrage, as (2c) shows. Finally, dividends must be non-negative.

Interior solution. The interior solutions of the optimization problem presented above (i.e., for $p > q \ \wedge \ E > 0$) are as follows:

(3a) $$p^*(\alpha,\kappa) = \frac{\kappa a - \alpha(a+r)}{\kappa - 2\alpha} \ , \ \kappa \neq 2\alpha$$

(3b) $$q^*(\alpha,\kappa) = \frac{r+c}{2} \ .$$

We highlight the dependence (respectively, independence) of the cooperative bank's optimal pricing policies on the parameters of the model in anticipation of the comparative statics that provide the most important insights of our model. It is easy to show that, at an interior equilibrium, the optimal loan rate, p^*, is strictly *increasing* in the fraction of votes controlled by the borrowers, α. On the other hand, the optimal loan rate is strictly decreasing in the fraction of borrowers that are members, κ.[2] The optimal deposit rate, q^*, is invariant with respect to α and κ because the loan and deposit pricing decisions are separable by virtue of the bank's access to the interbank market. Therefore, a borrower-dominated credit cooperative utilizes its market power in the deposit market precisely as a profit-maximizing bank would, paying less than the interbank rate.

Notice that, for $\alpha = 1$ (all members are borrowers), the borrowing rate takes on its *maximum* value. For $\kappa = 1$ (all borrowers are members), the maximum loan rate equals the interbank rate, r. When $\kappa < 1$, the maximum borrowing rate is above the interbank rate.

The optimal dividend payment, E^*, follows as a residual from equation (2b), replacing $x(p^*)$ and $y(q^*)$:

(3c) $$E^*(\alpha,\kappa) = \frac{-(a-r)^2\alpha(\kappa-\alpha)}{(\kappa-2\alpha)^2 b} + \frac{(r-c)^2}{4d} \ , \ \kappa \neq 2\alpha \ .$$

Focusing first on the interior solution ($p > q \ \wedge \ E > 0$), note that the cooperative bank's optimal dividend payment is strictly increasing in the fraction of votes controlled by members who are borrowers, α, while it is strictly decreasing in the fraction of borrowers that are members, κ.[3] In the limiting case in which the borrowers have all the votes, the dividend payout of the cooperative is simply the operating profit made on deposits, $(r - q)y = (r - c)^2 / (4d)$.

As α decreases from above toward $1/2$, the borrowers prefer dividend payments less and loan subsidies more. The optimal borrowing rate, p^*, decreases, which leads to an increase in the amount of loans made by the bank, $x(p^*)$. Because the deposit rate, q^*, and the quantity of deposits, $y(q^*)$, are unaffected by the level of α, the bank's profit decreases as α decreases. Hence, the dividend payment also decreases. Meanwhile, the bank's net supply of funds to the interbank market decreases (i.e., $y - x$ decreases).

Corner solutions. For a sufficiently low value of α $(\alpha > 1/2)$, the bank might reach a corner solution with either the borrowing rate equaling the deposit rate, $p = q$ (at $E \geq 0$), or with the dividend payment being equal to zero, $E = 0$ (at $p \geq q$), or both. If in the course of a decline of α the borrowing rate reaches the deposit rate at a dividend level greater than zero, the dividend payment will remain at this level for further decreases in α. We define $\hat{\alpha}$ to be the fraction of voting rights controlled by the borrowers at which the bank enters this corner solution.

The value $\hat{\alpha}$ is an empty set if, in the course of a decline in α, the dividend payment decreases to zero before the borrowing rate falls to the deposit rate. We define $\tilde{\alpha}$ to be the fraction of votes controlled by the borrowers at which the bank enters the corner solution of a zero dividend payment, $E = 0$, at a borrowing rate that is greater than or equal to the deposit rate, $p \geq q$. Except for the limiting case in which $\hat{\alpha}$ equals $\tilde{\alpha}$, only one corner solution can apply for a given set of parameters.

Empirical implications. We conclude that, for $1/2 < \alpha < \tilde{\alpha}$, the cooperative bank's optimal dividend payment does not vary with α, but remains constant at zero. Similarly, for $1/2 < \alpha < \hat{\alpha}$, the borrowing rate is independent of α and equals the deposit rate. Together with equations (3a-c), which apply to the interior equilibrium, these considerations prove the following lemma.

Lemma 1:

For $1/2 < \alpha \leq 1$ (borrower domination), an open credit cooperative's loan rate and dividend payment are increasing in α in the range $max\{\tilde{\alpha}, \hat{\alpha}\} < \alpha < 1$, and are constant in the range $1/2 < \alpha < max\{\tilde{\alpha}, \hat{\alpha}\} \leq 1$.

We can now state the following testable proposition.

Proposition 1:

For $1/2 < \alpha \leq 1$ (borrower domination), loan rates and dividend payments are positively correlated in the range $max\{\tilde{\alpha}, \hat{\alpha}\} < \alpha < 1$, and are uncorrelated in the range $1/2 < \alpha < max\{\tilde{\alpha}, \hat{\alpha}\} \leq 1$.

Proof: Follows immediately from Lemma 1.

Optimal borrowing and deposit rates set by a borrower-dominated cooperative bank are displayed in the left-hand side of Figure 1. The figure corresponds to parameter settings such that $\tilde{\alpha} > \hat{\alpha}$, $\kappa < 1$. If all members are borrowers ($\alpha = 1;$ point A), the cooperative bank prices loans above the interbank rate ($p > r$) and pays a dividend ($E > 0$; not shown). As α decreases, the borrowing rate and the dividend decline. At point B ($\alpha = \tilde{\alpha}$), the dividend reaches zero and its non-negativity constraint becomes binding. Further declines in α leave the borrowing rate unchanged because the non-negativity constraint remains binding. If $\tilde{\alpha}$ were an empty set, i.e., if the non-negativity constraint did not become binding before the decrease in α led the borrowing rate down to the deposit rate $(\, p = q \,)$, the borrowing rate and the dividend payment would decline with α until point C is reached $(\, \alpha = \hat{\alpha} \,)$.

Output-maximizing vs. profit-maximizing incentives. Perhaps the most interesting—and counterintuitive—aspect of our discussion so far is that a borrower-dominated open credit cooperative optimally charges a higher loan rate, the larger is the borrowers' majority. There are two conflicting effects operating on the decision-making group, corresponding to the two parts of the borrowers' objective function. First, the output-maximizing incentive of the controlling group relates to the surplus they obtain in transacting with the cooperative; in this case, loans are more favorably priced than borrowers could obtain elsewhere. This would lead one to expect that a borrower majority might decrease the loan rate as the borrower majority increased. Pricing-related benefits are shared with non-member borrowers, however, so there is an obvious inefficiency from the dominant group's perspective in delivering benefits this way.

The second incentive of the dominant group is to maximize the cooperative's operating profit so a larger dividend payment can be made. This keeps benefits generated by the cooperative away from non-members, but dividends must be shared with depositor members about whose welfare borrowers do not care. Yet, as the significance of depositor members dwindles, the profit-maximizing incentive of the dominant group at some point overpowers their output-maximizing incentive. Thus, as the borrowers' majority increases, dividends become increasingly attractive and loan interest rates are raised in order to redirect the cooperative's benefits.

Holding the fraction of borrowers in the membership constant (α), variations in the fraction of the cooperative's lending business that is done with members (κ) also matter. Figure 2 shows the borrower-dominated open credit cooperative's optimal loan rate as a function of α for several values of κ. The uppermost line traces out, for increasing values of α, the optimal loan rate for the case in which only 30 percent of the borrowers are members ($\kappa = 0.3$). The line closest to the bottom of the figure shows the dependence of the optimal borrowing rate on α when all borrowers are members ($\kappa = 1$). The intermediate lines in the figure represent optimal loan-rate schedules for values of κ that increase in increments of 0.1, reading from top to bottom.

In general, as κ rises, the optimal borrowing rate decreases, holding all else constant. This is consistent with the intuition developed above that member borrowers will channel an increasing proportion of the benefits they obtain from the cooperative bank into the form of borrowers' surplus, the less this leaks out to non-members. The higher κ, the more likely the cooperative will find itself in a corner solution in which the non-negativity constraint of the dividend payment binds $(E = 0; \alpha = \tilde{\alpha})$. For the vector of values (a,b,c,d,r) chosen for Figure 2, the constraint $p \geq q$ never binds, which means that the floor under the borrowing rate exceeds the deposit rate.[4]

Figure 3 demonstrates how the optimal dividend payment is related to the fraction of votes held by borrowers, α, and to the fraction of borrowers that are members, κ. The same set of values for the vector (κ, a,b,c,d,r) was used to draw the figure. As in Figure 2, the uppermost line represents a case in which 30 percent of the borrowers are members ($\kappa = 0.3$), while the line nearest the bottom of the figure corresponds to the case in which all borrowers are members. As with the optimal loan rate in Figure 2, the optimal dividend decreases with an increase in κ.

C. A Depositor-Dominated Cooperative Bank

We now assume that $\alpha < 1/2$, that is, the bank is lender- or depositor-dominated. This corresponds to the current situation in many credit cooperatives, including the German cooperative banks. For notational simplicity, we replace the fraction of the members that are depositors, $1-\alpha$, with the parameter $\beta \ (1/2 < \beta \leq 1)$. We define $\lambda \ (0 < \lambda \leq 1)$ as the fraction of depositors that are members. The fraction of deposit business done with members is $\lambda \ (0 < \lambda \leq 1)$. A depositor-dominated cooperative bank solves the following optimization problem:

(4a) $$\underset{p,q,E}{Max} \left\{ \lambda \cdot y(q)\left(\frac{q-c}{2}\right) + \beta \cdot E \right\}$$

subject to

(4b) $$E = p \cdot x(p) - q \cdot y(q) + r\left[y(q) - x(p)\right]$$

(4c) $$p \geq q$$

(4d) $$E \geq 0,$$

where $\beta > 1/2$. The objective function is the sum of the member depositors' surplus from lending to the cooperative and their share of the cooperative's operating profit. The depositors' surplus is the integral between the deposit supply curve and the deposit rate, calculated over the total amount of deposits. Member depositors capture only a fraction λ of the depositors' surplus created, the remainder going to non-member depositors. Likewise, member depositors receive only the fraction β of the cooperative's operating profit. As noted above in the borrower-dominated case, the depositor-dominated open credit cooperative balances output-maximizing and profit-maximizing incentives subject to an analogous set of constraints.

Interior solution. An interior solution of the depositor-dominated open credit cooperative's problem, expressed in terms of the model's key parameters, is the following (for $p > q \;\wedge\; E > 0$):

(5a) $$p^*(\beta,\lambda) = \frac{a+r}{2}$$

(5b) $$q^*(\beta,\lambda) = \frac{\lambda c - \beta(c+r)}{\lambda - 2\beta} \;\; , \;\; \lambda \neq 2\beta \; .$$

The optimal borrowing rate, p^*, is independent of β and λ and lies above the interbank rate, *r*, because the depositor-dominated cooperative bank exercises its market power to the detriment of all borrowers, member and non-member. Meanwhile, the optimal deposit rate, q^*, is strictly decreasing in the fraction of votes controlled by the lenders, β, and is strictly increasing in the fraction of lenders that are members, λ.[5] For $\beta = 1$ (all members are depositors), the deposit rate takes on its minimum value. For $\lambda = 1$ (all depositors are members), the minimum deposit rate equals the interbank rate r. For $\beta = 1$ the minimum deposit rate lies below the interbank rate.

As in a borrower-dominated cooperative bank, the optimal dividend payment in the depositor-dominated bank, E^*, follows directly from equation (2b) for $x(p^*)$ and $y(q^*)$:[6]

(5c) $$E^*(\beta,\lambda) = \frac{-(c-r)^2\beta(\lambda-\beta)}{(\lambda-2\beta)^2 d} + \frac{(r-a)^2}{4b} \;\; , \;\; \lambda \neq 2\beta \; .$$

The dividend payment is strictly increasing in the fraction of depositors in the membership, β, and is strictly decreasing in the fraction of depositors that are members, λ.[7] In the limiting case in which all members are depositors, the optimal dividend is precisely the operating profit the credit cooperative earns on lending, $(p-r)x = (r-a)^2/(4b)$.

Depositors prefer dividend payments less, and they prefer mark-ups in the deposit rate more, as β decreases toward $1/2$. As a consequence of optimally higher deposit rates, q^*, a larger amount of deposits are attracted, $y(q^*)$. With the borrowing rate, p^*, and the quantity of loans, $x(p^*)$, invariant with respect to β, the bank's operating profit—hence also its dividend—decreases as depositor dominance increases. At the same time, the bank's net supply of funds to the interbank market, $y-x$, increases.

Corner solutions. One or two constraints may become binding as β falls toward $1/2$, producing a corner solution. One type of corner solution has the deposit rate equal to the loan rate. Another corner solution is characterized by a zero dividend payment. We let $\hat{\beta}$ denote the fraction of depositor members at which the bank enters the corner solution with $q = p$ (at $E \geq 0$), and we let $\tilde{\beta}$ denote the fraction of depositor members at which the bank's dividend becomes zero, $E = 0$ (at $q \leq p$).

It is easy to see that the dividend payment does not vary with β in the range $1/2 < \beta < \tilde{\beta}$, while the deposit rate is independent of β in the range $1/2 < \beta < \hat{\beta}$. Together with equations (5a)-(5c), which describe the interior equilibrium, we have the following lemma.

<u>Lemma 2:</u>

For $1/2 < \beta \leq 1$ (depositor domination), an open credit cooperative's deposit and dividend rates are increasing in β in the range $max\{\tilde{\beta},\hat{\beta}\} < \beta < 1$, and are constant in the range $1/2 < \beta < max\{\tilde{\beta},\hat{\beta}\}$.

We can now state the following testable proposition.

Proposition 2:

For $1/2 < \beta \leq 1$ (depositor domination), deposit rates and dividend payments are positively correlated in the range $max\{\tilde{\beta}, \hat{\beta}\} < \beta < 1$, and are uncorrelated in the range $1/2 < \beta < max\{\tilde{\beta}, \hat{\beta}\} \leq 1$.

Proof: Follows immediately from Lemma 2.

Optimal borrowing and deposit rates set by a depositor-dominated cooperative bank are displayed in the right-hand side of Figure 1. The figure corresponds to parameter settings such that $\tilde{\beta} > \hat{\beta}$, $\lambda < 1$. If all members are depositors ($\beta = 1$; point F), the cooperative bank prices deposits below the interbank rate ($q < r$) and pays a dividend ($E > 0$; not shown). As β decreases, the deposit rate increases and the dividend declines. At point G ($\beta = \tilde{\beta}$), the dividend reaches zero and its non-negativity constraint becomes binding. Further declines in β leave the deposit rate unchanged because the non-negativity constraint remains binding. If $\tilde{\beta}$ were an empty set, i.e., if the non-negativity constraint did not become binding before the decrease in β led the deposit rate up to the loan rate ($q = p$), the deposit rate would continue to increase and the dividend would decrease with β until point H is reached ($\beta = \hat{\beta}$).

Output-maximizing vs. profit-maximizing incentives. A depositor-dominated open credit cooperative optimally offers a *lower* deposit rate, the larger is the depositors' majority. As discussed above in the context of a borrower-dominated cooperative, there are two conflicting incentives, corresponding to the two parts of the depositors' objective function, namely, to maximize output-related benefits and to maximize profit and dividends. The output-maximizing incentive alone would lead one to expect that a depositor majority might increase the deposit rate as the depositor majority increased. Pricing-related benefits are shared with non-member depositors, however, blunting this incentive.

The second incentive of the dominant group is to maximize the cooperative's operating profit so a larger dividend payment can be made, as discussed above for the borrower-dominated cooperative. Dividends avoid leakage of benefits to non-members, but they must be shared with borrower members who are not part of the majority group. As the significance of borrowing members dwindles, however, the profit-maximizing incentive of the dominant group overtakes their output-maximizing incentive. Thus, as the depositors' majority increases, dividends become increasingly attractive and deposit interest rates are lowered in order to deliver benefits most efficiently.

Holding the fraction of depositors in the membership constant (β), variations in the fraction of the cooperative's deposit business that is done with members (λ) also matter. Figure 4 shows the depositor-dominated open credit cooperative's optimal deposit rate as a function of β for several values of λ.[8] The lowest line traces out, for increasing values of β, the optimal deposit rate for the case in which only 30 percent of the depositors are members ($\lambda = 0.3$). The uppermost line in the figure shows the dependence of the optimal deposit rate on β when all depositors are members ($\lambda = 1$). The intermediate lines in the figure represent optimal deposit-rate schedules for values of λ that increase in increments of 0.1, reading from bottom to top.

In general, as λ rises, the optimal deposit rate increases, holding all else constant. This is consistent with the intuition developed above that member depositors will channel an increasing proportion of the benefits they obtain from the cooperative bank into the form of depositors' surplus, the less this leaks out to non-members. The higher is λ, the more likely the cooperative will find itself in a corner solution in which the non-negativity constraint of the dividend payment binds $(E = 0; \beta = \tilde{\beta})$. For the vector of values (a,b,c,d,r) chosen for Figure 4, the constraint $q \leq p$ never binds, which means that the ceiling over the deposit rate lies below the loan rate.[9] The behavior of the optimal dividend is analogous in a depositor-dominated cooperative to that of the borrower-dominated cooperative discussed above and shown in Figure 3, so it is not shown separately.

III. Empirical Evidence

This section discusses empirical evidence from the German cooperative-banking sector that bears on our hypotheses regarding the composition of the membership and the cooperative's pricing and dividend policies. First, we discuss the 19th-century German cooperative banks and their borrower orientation. Our empirical evidence is informal in this case. Then, we turn to the late 20th-century German cooperative banks and their depositor orientation. Our empirical evidence for this era is more systematic and is explored in detail below.

A. 19th-Century German Cooperative Banks

German cooperative banks emerged in the mid-1800s and were borrower dominated (see Bonus, 1986; Bonus and Schmidt, 1990). In fact, the sole purpose of the early cooperatives was to borrow from city banks in order to lend to their members. In the early days, it was the members themselves who made all loan decisions. These banks did no lending to non-members, so they were effectively closed credit cooperatives.[10]

Our model makes several predictions that can be compared to the operations of early cooperative banks. As noted, they did not generate any of their own loanable funds; nor did they pay dividends to members. All members wanted to borrow. Equation 4 of our model shows that, if the deposit-supply curve facing the bank intersects the vertical axis at the interbank rate $(c = r)$ and if all members are borrowers, then no dividends are paid. In other words, our model correctly predicts that no operating profit will be targeted and consequently no dividends will be paid.

B. Late 20th-Century German Cooperative Banks

The typical modern German cooperative bank is depositor dominated and pays dividends to its members (Grosskopf, 1990)[11]. Table 1 shows that the membership rolls of cooperative banks are dominated by employed persons, retirees, and other family members. These groups typically are net lenders to cooperative banks (which do not extend first-mortgage loans). In fact, over the period we analyze, the primary cooperative banks were net suppliers of funds to the interbank market (OECD, 1992, 1999). Thus, the typical cooperative bank is likely to be depositor-dominated.

Proposition 2 states that (for a lender-dominated cooperative bank) the deposit rate varies inversely with the dividend rate in a depositor-dominated cooperative bank with $\beta > \tilde{\beta}$. We test this hypothesis with the following regression equation: [12]

(6) $$ln(q_t / q_{t-1}) = \gamma_0 + \gamma_1 ln(r_t / r_{t-1}) + \gamma_2 ln(e_t^j / e_{t-1}^j) + \varepsilon_t \ .$$

where e stands for the dividend rate (in contrast to E, which denoted the total dividend payment in the model). We distinguish two concepts of the dividend rate, as indicated by the superscript j $(j = c,m)$. The first concept, e^c, looks at distributed profit relative to the capital and reserves of the bank. The second concept, c^m, defines the dividend rate as the quotient of the distributed profit and the number of members.

The loan rate, p, is independent of member preferences in a depositor-dominated, dividend-paying regime. The loan rate has a constant elasticity with respect to the interbank rate, r. [13] This allows us to substitute the interbank rate for the borrowing rate in the regression equation. While the model predicts that the elasticity of the borrowing rate to the interbank rate is smaller than one (but greater than zero) in the assumed depositor-dominated, dividend-paying regime, the corresponding elasticity of the deposit rate is greater than one. [14] Thus, the parameter γ_1, which equals the elasticity of the ratio of the deposit rates, q_t / q_{t-1}, with respect to the ratio of the borrowing rates, p_t / p_{t-1}, must be greater than one. The parameter γ_0 controls for a possible (linear) time trend in the log deposit rate, $ln(q)$.

We use annual data on the aggregated German primary cooperative banking sector, which accounted for almost 12 percent of the balance-sheet total of the entire German banking system at the end of 1998 (OECD, 1999). These are local retail banks, constituting the bottom level in the three-tier cooperative banking sector. Our data exclude the regional cooperative banking institutions and DG Bank, the top-tier bank in the cooperative sector. We use data from the OECD data source, *Bank Profitability* (1992, 1999), covering the period 1981-1997, and from the Bundesverband der Deutschen Volksbanken und Raiffeisenbanken (http://www.vrnet.de). We measure deposit rates as the ratio of interest expenses to the sum of the following liabilities: non-bank deposits, interbank deposits, bonds, and borrowing from central bank. We measure the borrowing rate as the ratio of interest income to the following categories of assets: loans, securities, and interbank deposits. Thus, our empirical measures of the deposit and the borrowing rates include interbank market activity. This is because the data do not allow us to disaggregate interest expenses and interest income by the various types of liabilities and assets. As mentioned above, we measure the dividend payment rate as the ratio of distributed profit to capital and reserves or, alternatively, to the number of members. Table 2 provides descriptive statistics for these four rates of return and the interest-rate spread, $p-q$.

The descriptive statistics in Table 2 reveal an important implication of our model, namely, that the deposit rate is more volatile than the lending rate. The elasticity of the deposit rate with respect to changes in the interbank rate is greater than one, whereas the elasticity of the borrowing rate with respect to the interbank rate is smaller than one (but greater than zero). The coefficient of variation (defined as the standard deviation normalized by the mean) of the deposit rate equals 0.174, whereas the coefficient of variation of the lending rate is only 0.130.

We are left with only 16 observations for estimating regression equation (6) when employing a one-period lag. Therefore, we investigate two types of bootstrapped *t*-intervals in addition to the standard *t*-values. The Bera-Jarque statistic that tests for normality serves as a further test of robustness.

The empirical results are displayed in Table 3.[15] As predicted by Proposition 2, the deposit rate and the dividend rate vary inversely. The standard *t*-value shows that this regression coefficient is significantly different from zero at the 5-percent level. The regression coefficient of the lending rate is significantly greater than one, as predicted by the model.[16] The coefficient γ_0 is significantly greater than one, indicating a linear trend in the log deposit rate. This trend is small in economic terms, however, given that the mean log deposit rate equals -3.122. The Bera-Jarque value in Table 3 does not indicate a violation of the assumption that the errors are normally distributed.

The results of two bootstrapping procedures are displayed in Table 4. They reinforce the main regression results. The first bootstrapping method generates Student's *t*-intervals under the assumption of normally distributed errors. These intervals confirm the significance of the tests of the regression coefficients at the 5-percent level. The second bootstrapping procedure provides a bootstrap-*t* interval, which does not rely on the normality assumption.[17] These intervals also validate the significance tests at the 5-percent level.

Our results support Proposition 2, which states that an open credit cooperative's deposit rate and dividend rate will vary inversely. Figure 5 displays the regression equation from Table 3 for a zero log change in the dividend rate. The graph was drawn for the range of actual observations. The regression line shows that the log change in the deposit rate, $ln(q_t / q_{t-1})$, varies more than proportionately with the log change in the borrowing rate, $ln(p_t / p_{t-1})$. The vertical difference between the regression line and the intersection of the dashed lines indicates a small positive linear trend in the log deposit rate.

We applied the same statistical procedures to a member-based concept of the dividend ratio, e^m, as a sensitivity analysis. This concept of the dividend payment rate takes into account the fact that cooperative members do not have a claim on the cooperative's retained earnings (in contrast to traded shares in stock corporations). [18] Typically, a cooperative's shares are held in roughly equal proportions by all members; many cooperative banks have ceilings on the number of shares one individual may own.

The empirical analysis using the member-based dividend payment rate confirms our earlier findings using the capital-based dividend measure, e^c. The results are shown in Tables 5 and 6. The regression coefficient of the borrowing rate is again significantly greater than one, while the regression coefficient of the dividend ratio is significantly negative. The positive linear trend in the log deposit rate is now more than twice as large as before, but it is still small in economic terms.

IV. Conclusion

A credit cooperative has three channels for allocating benefits to its members: (high) deposit interest rates, (low) loan interest rates, and dividend payments. Using a simple model and empirical evidence from the German cooperative banking sector, this paper shows that both the distribution of member preferences and the amount of non-member business the cooperative does influence its optimal pricing and dividend policies. The output-maximizing incentive of a cooperative varies positively with the proportion of member business because the members of the controlling group are obliged to share progressively less of the subsidy with non-members. For a fixed fraction of member business, on the other hand, the greater the skewness of member preferences toward loan (deposit) business with the credit cooperative, the larger the optimal dividend and the *higher (lower)* the optimal loan (deposit) interest rate. This profit-maximizing effect arises because an increasingly overwhelming controlling group internalizes the cooperative's incentive to exploit its market power to a greater extent—even at its own expense. In this case, the larger controlling group must share less of the dividend payout with other members.

Empirical evidence from the German cooperative banking sector supports a version of the latter prediction, namely, that in an increasingly borrower-dominated open credit cooperative, average deposit rates tend to fall as dividend payouts rise. Thus, optimal pricing and dividend policies are closely interrelated, a connection not explored in earlier work on this topic.

[1] We assume that there is no wealth effect of the dividend payments on the supply and demand function of the members.

[2] These two statements are true if (and only if) $a - r > 0$, as assumed.

[3] These two statements are true if (and only if) $2\alpha - \kappa > 0$, a condition that always holds.

[4] For Figure 2, we chose the following values: a=0.2; b=c=0.01; d=0.005; r=0.1. Thus, the deposit rate, q, equals 0.055. The floor under the borrowing rate that results from the non-negativity constraint of the dividend payment is approximately 0.069.

[5] These two statements are true if (and only if) $r - c > 0$, as assumed.

[6] As before, we assume the bank's choices of loan and deposit quantities follow directly from its choice of interest rates according to the demand and supply curves it faces. We rule out the possibility of separating the price- and quantity-setting decisions because this would introduce another level of complexity that does not add any insight to the problem analyzed here.

[7] These two statements are true if (and only if) $2\beta - \lambda > 0$, a condition that always holds.

[8] The same parameter values were used for Figure 4 as in Figures 2 and 3.

[9] The borrowing rate, p, equals 0.150. The ceiling to the deposit rate that results from the non-negativity constraint of the dividend payment equals ≈0.112.

[10] The German Cooperative Banking Act from 1889 disallowed lending to non-members.

[11] In terms of our model, the fact that cooperative banks typically pay dividends implies that the fraction of votes controlled by lenders must exceed the minimum level, $\tilde{\beta}$, at which positive dividend payments are optimal.

[12] We use log changes because rates of return are typically co-integrated. We did not employ an error-correction-model because the observations are annual and their number is small (Hamilton, 1994).

[13] The elasticity of the borrowing rate with respect to the inter-bank rate equals $r/(r+a) < 1$.

[14] The elasticity of the deposit rate with respect to the inter-bank rate equals $\beta r/(\beta r - c(\lambda - \beta)) < 1$ in the interior solution of the depositor-dominated regime. For $r > c > 0$ (which we assumed), it is greater than zero.

[15] The *t*-values and the Wald-statistic are White (1980) corrected. We tested for serial correlation using the Ljung-Box (1978) test statistic with a standard lag length of *floor*($4(T/100)^{2/9}$), where *floor* means rounded down to the nearest integer. The null hypothesis of no serial correlation could not be rejected.

[16] The test statistics are not shown. They were carried out within the regression framework presented in Table 3, using two bootstrapping procedures.

[17] For details on these two bootstrapping procedures, see Efron and Tibshirani (1993, pp. 158-62).

[18] The majority group could, of course, vote to pay out the accumulated earnings as a dividend.

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TABLE 1: MEMBERSHIP TYPES

Type of Member		1980	1990	1998
		Percent		
Entrepreneurs	Agriculture and forestry [1]	7.5	4.3	2.0
	Manufacturing and Construction	4.1	3.3	2.2
	Wholesaling and Retailing	3.1	2.2	1.6
	Services	4.4	3.3	2.0
	Other businesses	0.6	0.5	---
Self-employed		---	---	0.9
Subtotal		*19.7*	*13.6*	*8.7*
Employed Persons		59.1	58.1	55.5
Retirees		11.2	13.6	14.3
Others [2]		9.7	14.3	21.3
Subtotal		*80.0*	*86.0*	*91.1*
Public institutions		0.3	0.4	0.2
Total		100	100	100

[1] For 1998 including fishing.
[2] Mainly household members that are neither employed, self-employed or retired.
Source: Bundesverband der Deutschen Volksbanken und Raiffeisenbanken, provided on request.

TABLE 2: DESCRIPTIVE STATISTICS

Variable	Minimum	Median	Mean	Maximum	Standard Deviation	Variation Coefficient [†]
Borrowing rate (p)	0.063	0.077	0.076	0.096	0.010	0.130
Deposit rate (q)	0.033	0.043	0.045	0.059	0.008	0.174
Spread $(p-q)$	0.024	0.031	0.032	0.038	0.004	0.111
Dividend rate (e^c)	0.036	0.046	0.049	0.066	0.008	0.163
Dividend rate (e^m) (DM per member)	67.09	76.90	93.98	133.50	25.68	0.273

[†] Mean divided by standard deviation.

Sources: OECD (1992, 1999); Bundesverband der Deutschen Volksbanken und Raiffeisenbanken (http://www.vrnet.de).

TABLE 3: REGRESSION RESULTS (e^c)

Dependent Variable: Deposit Rate (q)		
Independent Variable	Coefficient	t-Statistic
Linear Trend	1.333×10^{-2}	2.269 **
Borrowing rate (p)	1.715	18.744 ***
Dividend rate (e^c)	-1.926×10^{-1}	-2.186 **
R^2	0.946	
$\overline{R}^2$	0.938	
Bera-Jarque value	2.940	
Wald statistic	472.4 ***	
Number of observations	16	

/* Significant at the 5/1 percent level (t-tests are two-tailed).

TABLE 4: BOOTSTRAPPING RESULTS (e^c)

Dependent Variable: Deposit Rate (q)			
Independent Variable	Coefficient	Bootstrapped Student's t 90-Percent Interval	Bootstrap-t 90-Percent Interval
Linear Trend	-1.333×10^{-2}	+/- 1.267×10^{-2}	-1.258×10^{-2}; 1.160×10^{-2}
Borrowing rate (p)	1.715	+/- 1.987×10^{-1}	-1.786×10^{-1}; 1.970×10^{-1}
Dividend rate (e^c)	-1.926×10^{-1}	+/- 1.830×10^{-1}	-1.908×10^{-1}; 1.677×10^{-1}
Number of draws		2,500	2,500

TABLE 5: REGRESSION RESULTS (e^m)

Dependent Variable: Deposit Rate (q)		
Independent Variable	Coefficient	t-Statistic
Linear Trend	2.914×10^{-2}	2.845 ***
Borrowing rate (p)	1.726	19.032 ***
Dividend rate (e^m)	-2.514×10^{-1}	-2.372 **
R^2	0.955	
$\overline{R}^2$	0.948	
Bera-Jarque value	1.690	
Wald statistic	483.4 ***	
Number of observations	16	

/* Significant at the 5/1 percent level (t-tests are two-tailed).

TABLE 6: BOOTSTRAPPING RESULTS (e^m)

Dependent Variable: Deposit Rate (q)			
Independent Variable	Coefficient	Bootstrapped Student's t 90-Percent Interval	Bootstrap-t 90-Percent Interval
Linear Trend	-2.914×10^{-2}	+/- 1.991×10^{-2}	-2.202×10^{-2}; 1.759×10^{-2}
Borrowing rate (p)	1.726	+/- 2.019×10^{-1}	-1.812×10^{-1}; 2.173×10^{-1}
Dividend rate (e^m)	-2.514×10^{-1}	+/- 2.175×10^{-1}	-2.345×10^{-1}; 1.998×10^{-1}
Number of draws		2,500	2,500

FIGURE 1: VOTING DISTRIBUTION AND PRICING OF FINANCIAL SERVICES

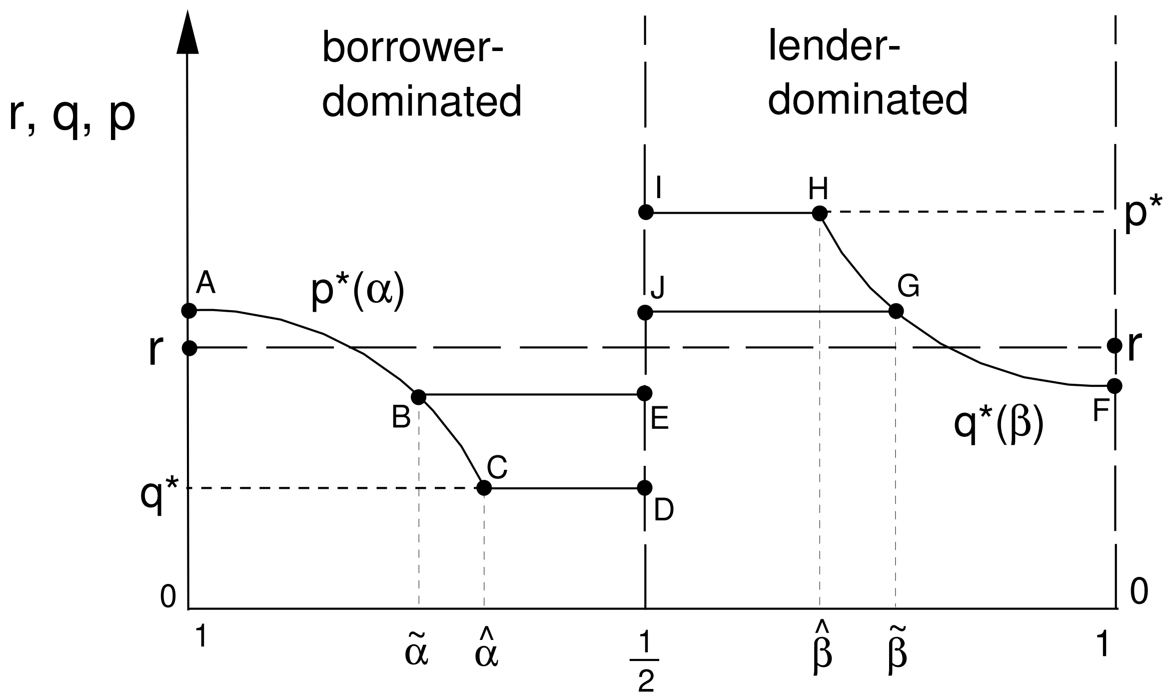

FIGURE 2: NON-MEMBER BORROWERS AND BORROWING RATE

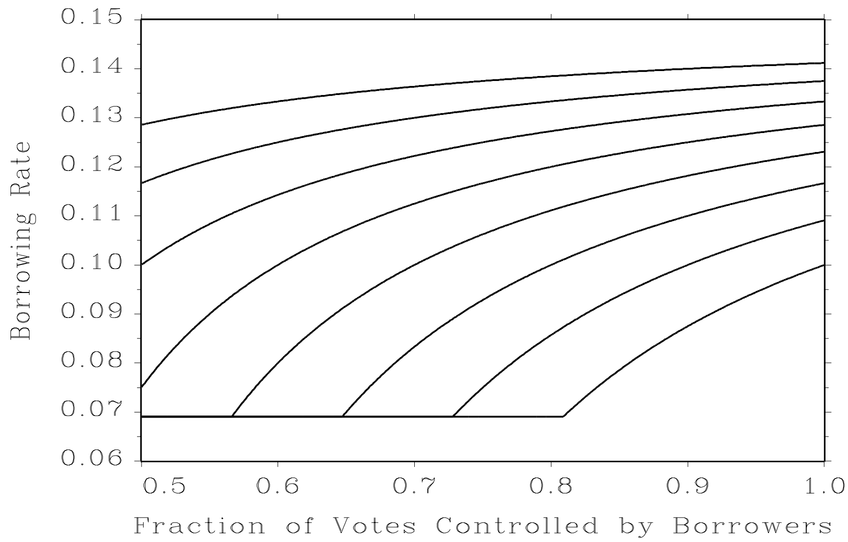

FIGURE 3: NON-MEMBER BORROWERS AND DIVIDEND PAYMENT

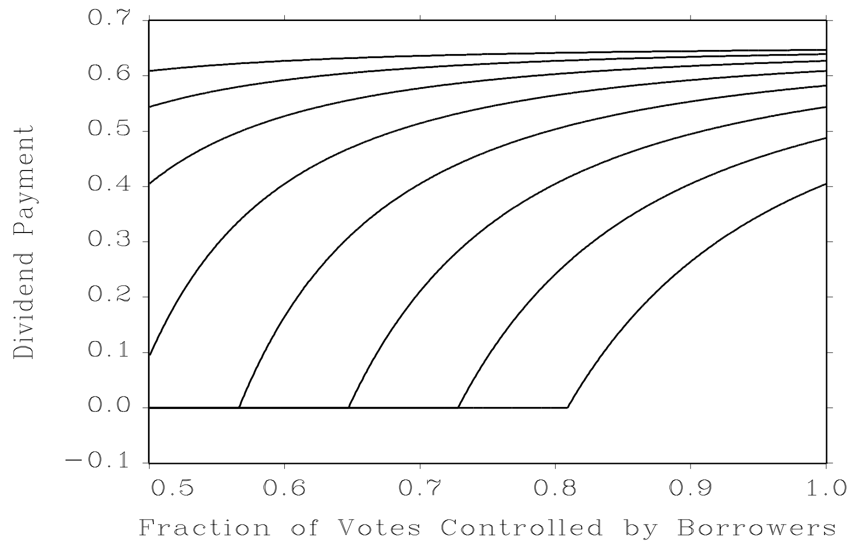

FIGURE 4: NON-MEMBER LENDERS AND DEPOSIT RATE

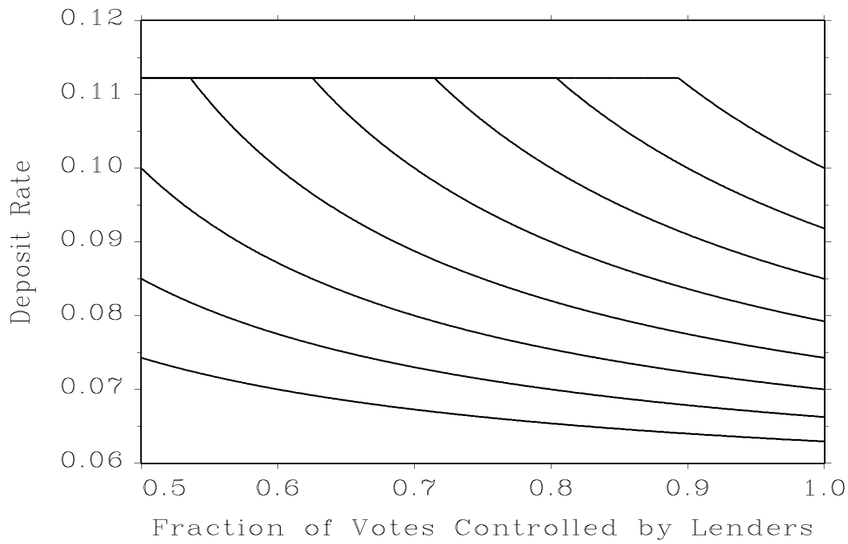

FIGURE 5: REGRESSION EQUATION AT ZERO LOG CHANGE IN DIVIDEND RATE